and *Triticum vulgare*, with the view of testing the applicability of the ideas set forth in BLACKMAN'S[8] "optima and limiting factors" to the process of respiration. In general the experiments were run six hours, and the CO_2 production determined for each hour. Up to 10° the CO_2 produced per hour was constant for the six hours. At higher temperatures, up to 20°, there was a rise for four or five hours. This rise is hard to explain in the light of the facts that the seeds were germinated at approximately 20°, that it occurred regardless of the age of the seedlings, and that it was followed by a corresponding fall. At constant temperatures above this, up to 40°, a fluctuation in CO_2 production was apparent. Especially between 30° and 40° this manifested itself by a rapid fall for the first two hours, followed by a later rise ranging over one to two hours, followed by a later continuous fall. The author assumes that two distinct processes are differently affected by the continuous high temperature: one early depressed, marking the fall; the other later stimulated, showing the rise. This fact he suggests may be related to the double nature of CO_2 production in respiration noted by PALLADIN, in which he assumes the action of oxidase on the one hand and of carbonase on the other. At still higher temperatures there is a continual fall in CO_2 production. The temperature at which one type of behavior changes to another is determined by the nature of the stored food, as the following tables show:

	Lupinus	Pisum	Triticum
Rise noticeable	15–20°	20–25°	30°
Fluctuation	20–25°	30°	35°
Continual falling	25°	35°	40°
Protein	37%	22%	12%
Starch	none	54%	74%

The VAN'T HOFF law applies for *Pisum* and *Triticum* from 0°–20°, and for *Lupinus* up to 25°. The coefficient for a temperature difference of 10° lies between 2 and 3. The continual falling in CO_2 production with continual exposures at higher temperatures agrees with BLACKMAN'S results. BLACKMAN found that in photosynthesis the initial rate at any given high temperature (30–40°) could be figured in two ways, giving agreeing results: by applying the VAN'T HOFF coefficient to the measurements at lower temperatures where the rate is constant, or by taking several later determinations at the given temperatures and from these extrapolating the initial value. KUIJPER finds that these methods will not apply to the CO_2 yield in respiration, because of the appearance of the two antagonistic factors at temperatures between 30° and 40°, and because of the non-application of the VAN'T HOFF law at the higher temperatures.—WILLIAM CROCKER.

Permeability.—CZAPEK[9] has published a preliminary article upon the effect of various reagents upon the precipitation of tannins in plant cells by means of caffein and ammonium carbonate. If slices from the epidermis of *Echeveria*

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[8] BLACKMAN, F. F., Annals of Botany **19**:281–295. 1905.

[9] CZAPEK, F., Versuchs über Exosmose aus Pflanzenzellen. Ber. Deutsch. Bot. Gesell. **28**:159–169. 1910.

leaves are placed in $n/1000$ acid for 24 hours, and then treated with caffein solution, no tannin is precipitated; while the controls kept in water show a heavy precipitate. The acid solution showed a strong tannin test with iron salts. CZAPEK concludes that the acid renders the *Plasmahaut* permeable to tannins, and that they gradually diffuse out. In strong acids he finds $n/6400$ the critical (minimum) concentration for inducing marked permeability. This is the concentration at which KAHLENBERG and TRUE found growth to cease. CZAPEK believes the stoppage of growth is directly due to reduced turgor, resulting from the induced permeability of the protoplasm to contained substances. He recognizes that injuries appear in concentrations below the critical concentration for permeability. Various other substances give similar results. The critical concentration for phenol is 0.58 per cent or $n/16$; for resorcin, di-hydric phenol, 2.85 per cent or $n/4$; for pyrogallol tri-hydric phenol $n/4$. Among alcohols, the critical concentrations were methyl 15 per cent, ethyl 10–11 per cent, normal and iso-propyl 4–5 per cent, iso-butyl 1–2 per cent, amyl 0.5 per cent. In acetic acid the critical concentration is below that determined by its acid properties. The effect of external conditions upon the permeability of protoplasmic and other plant membranes is a subject that deserves much attention from plant physiologists. Animal physiologists are teaching us much in this field.—WILLIAM CROCKER.

Morphology of Sciadopitys.—LAWSON[10] has published an account of the gametophytes and embryo of *Sciadopitys*, one of the peculiar conifers of eastern Asia. The microspores are binucleate at shedding, and are received upon the so-called pollen cushion, which is the tip of the nucellus differentiated into a loose tissue of large thin-walled cells. During the first season only one more division occurs, that of the generative cell into the body cell and a free stalk nucleus. In the next season the body cell passes toward the tip of the pollen tube, which has entered an archegonial chamber, and there produces two unequal male nuclei. The formation of the megaspore tetrad is peculiar. The division of the mother cell nucleus is not accompanied by wall formation; but the subsequent division of the two daughter nuclei is; so that the tetrad comprises three cells, the middle one of which is binucleate. In these divisions the chromosome numbers prove to be 8 and 16. The innermost megaspore is the functioning one, enlarging very much, and becoming invested by the usual zone of nutritive cells. The female gametophyte is developed as in the majority of conifers, and there are four or six archegonia, each with its own investment of jacket cells and a deep archegonial chamber. A ventral nucleus is formed, but no ventral canal cell. In the development of the embryo, the free nuclei pass to the base of the egg at the four-nucleate stage, and the proembryo finally consists of three tiers of cells and one tier of free nuclei toward the egg cytoplasm. The middle tier of cells becomes the suspensor, while the embryo-forming tier becomes a mass of at least sixteen cells.—J. M. C.

10 LAWSON, A. ANSTRUTHER, The gametophytes and embryo of *Sciadopitys verticillata*. Annals of Botany **24**:403–421. *pls. 29–31*. 1910.